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SOLAR/2066-79/05

Monthly Performance Report

BILLINGS SHIPPING

MAY 1979

FEB 14 1980
U.S. DEPOSITORY

U.S. Department of Energy

National Solar Heating and Cooling Demonstration Program

National Solar Data Program

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MONTHLY PERFORMANCE REPORT
BILLINGS SHIPPING
MAY 1979

I. SYSTEM DESCRIPTION

The Billings Shipping solar site, located in Billings, Montana, is an enclosed freight distribution facility with 4,900 square feet of heated office space. The solar energy system is designed to provide 54 percent of the annual heating demand. The system has a roof-mounted flat-plate collector array that faces 10 degrees east of south at an angle of 50 degrees from the horizontal. The collector array manufactured by Lennox Industries, Inc., has a gross area of 1,848 square feet and uses a 50 percent propylene glycol and water solution for the energy transport fluid.

The collected solar energy is stored in a 2,500-gallon water tank which is insulated with two inches of polystyrene and buried three feet below the surface of the ground. Solar energy may be transferred to the space heating subsystem from this tank or transferred directly from the energy collection subsystem. This solar heated water passes through the solar portion of the air-handler unit space heating coil to provide space heating. Auxiliary space heating is obtained from heated water flowing through a separate loop of the air-handler unit. Auxiliary energy is supplied by a gas-fired hot water boiler.

The system, shown schematically in Figure 1, has four modes of operation.

Mode 1 - Collector-to-Heat Exchanger: This mode is entered when the collector surface reaches 130°F. Pumps P1 and P2 are activated simultaneously at this temperature and are shut off whenever the surface temperature falls below 100°F. Collector loop fluid circulates through the collector and heat exchanger. In this mode, pump P2 circulates solar heated water through the tube side of heat exchanger and then through valves V1 and V2, thus, bypassing storage and the heat exchanger coil located in the space heating duct. If the collector fluid leaving pump P1 is above

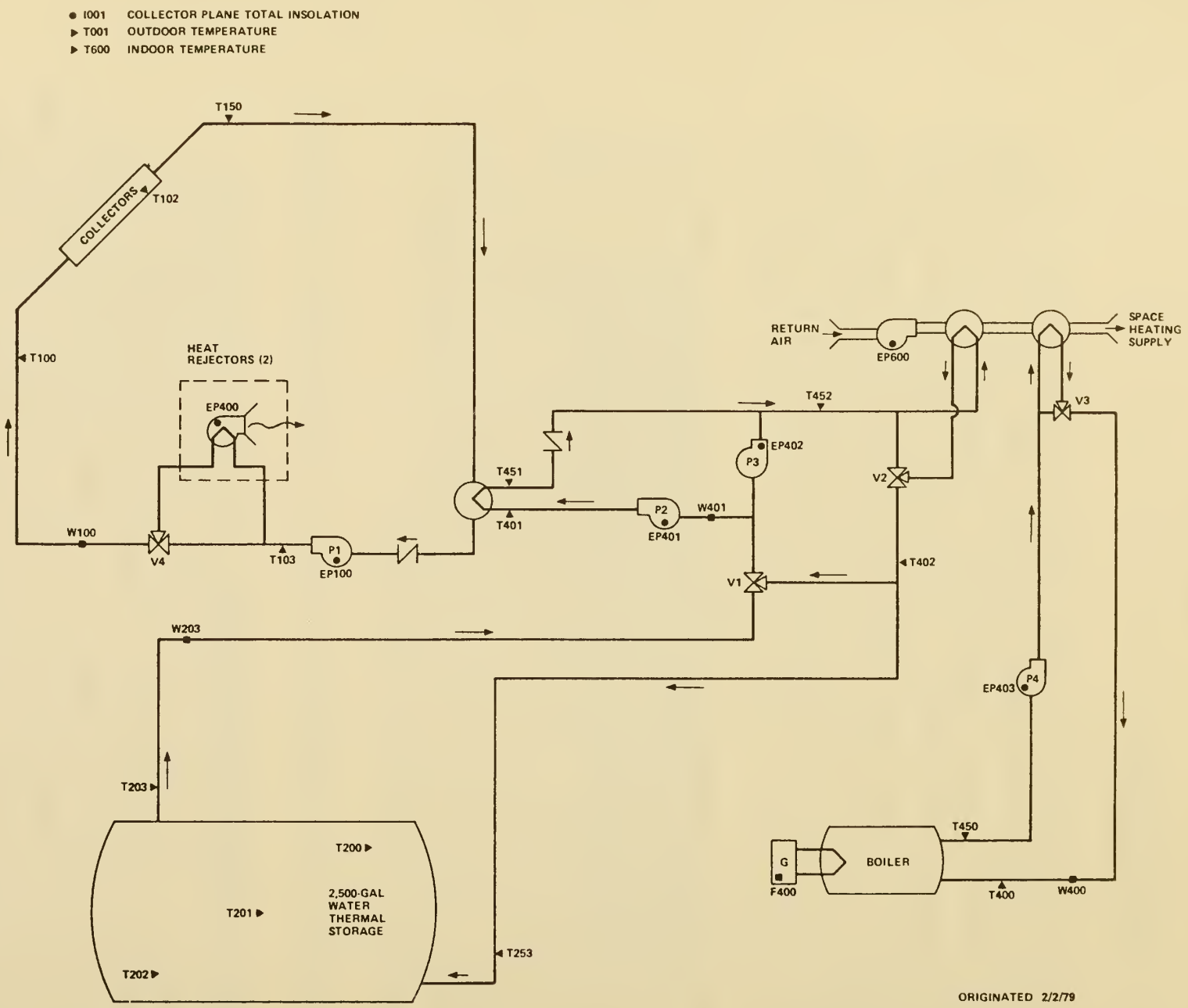

Figure 1. BILLINGS SHIPPING SOLAR ENERGY SYSTEM SCHEMATIC

195°F, valve V4 is switched to the heat rejector position and heat rejector fan power is applied.

Mode 2 - Heat Exchanger-to-Storage: This mode is entered when Mode 1 is active and when the temperature of the water leaving valve V2 is higher than storage, valve V1 opens, thus permitting water from the heat exchanger to be directed through storage. Otherwise, valve V1 is positioned to bypass storage.

Mode 3 - Heat Exchanger-to-Load: This mode is entered when Mode 1 is active and when there is a space heating demand. Water from the heat exchanger is directed through space heating coils in the air-handler unit by valve V2. When the space heating demand is satisfied, valve V2 is positioned to bypass the heating coils.

Mode 4 - Storage-to-Load: This mode is entered if there is a space heating demand when the heat exchanger loop is off and the storage temperature is above 80°F. Water is circulated by pump P3 from storage through valve V1 to the air-handler unit and back to storage. Valve V2 directs the water in the air-handler unit to the space heating coils.

II. PERFORMANCE EVALUATION

The system performance evaluations discussed in this section are based primarily on the analysis of the data presented in the attached computer-generated monthly report. This attached report consists of daily site thermal and energy values for each subsystem, plus environmental data. The performance factors discussed in this report are based upon the definitions contained in NBSIR 76-1137, Thermal Data Requirements and Performance Evaluation Procedures for the National Solar Heating and Cooling Demonstration Program.

A. Introduction

The solar energy system operated throughout May, satisfying 28 percent of the space heating demand. The building temperature was maintained at

an average of 74°F, with an outside ambient temperature average of 56°F. The use of solar energy resulted in a fossil energy savings of 7.7 million Btu at an electrical energy expense of 1.1 million Btu.

B. Weather

The measured average outside daily temperature for May of 56°F was near the long-term predicted value of 55°F. The maximum average daily temperature was 71°F, and the minimum was 38°F. The average measured insolation was 1,614 Btu/ft^2-day, which was within 1.5 percent of the 1,639 Btu/ft^2-day long-term estimate.

C. System Thermal Performance

Collector - Of 92.4 million Btu of solar energy incident on the collector array in May, 77.8 million Btu were available during collector subsystem operation, 20.7 million Btu were collected and 1.6 million Btu were rejected. The operation of the energy collection and storage subsystem pumps P1 and P2 required 0.9 million Btu (269 kwh) of electrical energy. The measured collector array efficiency was 22 percent.

Storage - Of the 20.7 million Btu of solar energy collected, 14.0 million Btu were transferred to the hot water loop by the heat exchanger. A total of 11.0 million Btu was delivered to storage, and 3.7 million Btu were removed from storage for distribution to the space heating subsystem. The net storage energy increase measured during the month was 0.4 million Btu, and 1.1 million Btu were lost by the storage loop in the distribution from the collector to storage. The net loss to the tank surroundings was 6.9 million Btu, and the efficiency was 37 percent. The average tank temperature was 140°F.

Space Heating Load - While transferring energy from the collectors to storage, 1.9 million Btu were delivered to the load, with a 0.04 million Btu loss from the load subsystem to the surroundings. During the

storage-to-load mode, 3.7 million Btu were transferred to the load subsystem, with a 0.9 million Btu loss. The net solar energy delivered to the load was 4.6 million Btu. The gas-fired boiler consumed 28.9 million Btu of fossil fuel and contributed 11.6 million Btu to the space heating subsystem. The total space heating load for the month was 16.3 million Btu, and the resulting solar fraction was 28 percent.

The space heating subsystem required 2.0 million Btu (574 kwh) of electrical operating energy; 1.8 million Btu (530 kwh) were required to operate the conventional air circulation system and boiler, and were not charged against the solar energy system savings.

D. Observations

Of the 20.7 million Btu of solar energy collected, 1.6 million Btu were rejected, 0.4 million Btu were added to storage, 4.6 million Btu were delivered to the space heating load and 14.1 million Btu were the net loss. This loss was distributed as follows: 5.1 million Btu between the collector and heat exchanger outlet, 1.1 million Btu between the heat exchanger and storage while storing energy, 6.9 million Btu from storage to surroundings, and 1.0 million Btu from load subsystem to surroundings while provided space heating.

During May, the collector loop operated while the collector absorber plate temperature ranged above the 100°F collector operating temperature but was less than storage temperature. Valve V1 remained in the heat-exchanger-to-storage position, and storage energy was transferred to the collector loop. This operation was recorded in the hourly performance factors in the form of negative values of collected energy and energy-to-storage. The net effects on the monthly performance factors were lowered collector efficiency, storage energy and solar fraction.

On May 8, the collector loop operated for short periods of time, collecting 0.1 million Btu. The collected energy transferred across the

heat exchanger was insufficient to heat the water in the storage lines to storage operating temperature, resulting in the negative value of energy to storage.

E. Energy Savings

The fossil fuel energy savings value was 7.7 million Btu (2,260 kwh) at an expense of 1.1 million Btu (314 kwh) of electrical energy.

III. ACTION STATUS

The collector heat exchanger outlet sensor appears to read inaccurately, and an alternate sensor is being used at this time.

It has been recommended that valve V1 be positioned to bypass storage when the collector heat exchanger outlet temperature decreases below storage temperature.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: BILLINGS SHIPPING BILLINGS, MONT. SOLAR/2066-79/05
REPORT PERIOD: MAY,1979

SITE/SYSTEM DESCRIPTION:
THE BILLINGS SHIPPING SOLAR ENERGY SYSTEM PROVIDES SPACE HEATING. A 50 PERCENT PROPYLENE GLYCOL SOLUTION IS USED AS THE HEAT TRANSFER MEDIUM IN THE COLLECTOR-HEAT EXCHANGER LOOP. HEATED WATER CIRCULATES FROM THE HX THROUGH THE AIR HANDLER UNIT AND IS RETURNED TO THE HX DIRECTLY OR THROUGH THE 2500 GALLON STORAGE TANK. A GAS FIRED BOILER PROVIDES AUXILIARY HEAT WHEN SOLAR ENERGY IS INSUFFICIENT.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	92.439	MILLION BTU
	50021	BTU/SQ.FT.
COLLECTED SOLAR ENERGY	20.650	MILLION BTU
	11174	BTU/SQ.FT.
AVERAGE AMBIENT TEMPERATURE	56	DEGREES F
AVERAGE BUILDING TEMPERATURE	74	DEGREES F
ECSS SOLAR CONVERSION EFFICIENCY	0.05	
ECSS OPERATING ENERGY	0.917	MILLION BTU
TOTAL SYSTEM OPERATING ENERGY	2.875	MILLION BTU
TOTAL ENERGY CONSUMED	52.587	MILLION BTU

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL	
LOAD	N.A.	16.259	N.A.	16.259	MILLION BTU
SOLAR FRACTION	N.A.	28	N.A.	28	PERCENT
SOLAR ENERGY USED	N.A.	4.631	N.A.	4.631	MILLION BTU
OPERATING ENERGY	N.A.	1.958	N.A.	2.875	MILLION BTU
AUX. THERMAL ENERGY	N.A.	11.628	N.A.	11.628	MILLION BTU
AUX. ELECTRIC FUEL	N.A.	N.A.	N.A.	N.A.	MILLION BTU
AUX. FOSSIL FUEL	N.A.	28.903	N.A.	28.903	MILLION BTU
ELECTRICAL SAVINGS	N.A.	-0.153	N.A.	-1.070	MILLION BTU
FOSSIL SAVINGS	N.A.	7.719	N.A.	7.719	MILLION BTU

SYSTEM PERFORMANCE FACTOR: 0.423

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM, FEBRUARY 28,1978, SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: BILLINGS SHIPPING BILLINGS, MONT. SOLAR/2066-79/05
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GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	97.523 GIGA JOULES
	568042 KJ/SQ.M.
COLLECTED SOLAR ENERGY	21.786 GIGA JOULES
	126895 KJ/SQ.M.
AVERAGE AMBIENT TEMPERATURE	13 DEGREES C
AVERAGE BUILDING TEMPERATURE	23 DEGREES C
ECSS SOLAR CONVERSION EFFICIENCY	0.05
ECSS OPERATING ENERGY	0.967 GIGA JOULES
TOTAL SYSTEM OPERATING ENERGY	3.033 GIGA JOULES
TOTAL ENERGY CONSUMED	55.479 GIGA JOULES

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL
LOAD	N.A.	17.153	N.A.	17.153 GIGA JOULES
SOLAR FRACTION	N.A.	28	N.A.	28 PERCENT
SOLAR ENERGY USED	N.A.	4.886	N.A.	4.886 GIGA JOULES
OPERATING ENERGY	N.A.	2.066	N.A.	3.033 GIGA JOULES
AUX. THERMAL ENG	N.A.	12.267	N.A.	12.267 GIGA JOULES
AUX. ELECTRIC FUEL	N.A.	N.A.	N.A.	N.A. GIGA JOULES
AUX. FOSSIL FUEL	N.A.	30.493	N.A.	30.493 GIGA JOULES
ELECTRICAL SAVINGS	N.A.	-0.162	N.A.	-1.129 GIGA JOULES
FOSSIL SAVINGS	N.A.	8.143	N.A.	8.143 GIGA JOULES

SYSTEM PERFORMANCE FACTOR: 0.423

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N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM, FEBRUARY 28,1978, SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENERGY COLLECTION AND STORAGE SUBSYSTEM (ECSS)

SITE: BILLINGS SHIPPING — BILLINGS, MONT. — SOLAR/2066-79/05
REPORT PERIOD: MAY,1979

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	AMBIENT TEMP DEG-F	ENERGY TO LOADS MILLION BTU	AUX THERMAL TO ECSS MILLION BTU	ECSS OPERATING ENERGY MILLION BTU	ECSS ENERGY REJECTED MILLION BTU	ECSS SOLAR CONVERSION EFFICIENCY
1	0.695	43	0.218	N	0.001	0.000	0.262
2	2.126	43	0.576	O	0.016	0.000	0.213
3	3.845	48	0.530	T	0.036	0.000	0.108
4	2.297	53	0.410		0.024	0.000	0.161
5	3.216	59	0.000	A	0.031	0.061	0.000
6	*	*	*	P	*	*	*
7	4.863	48	0.917	P	0.045	0.000	0.175
8	1.663	39	0.698	L	0.005	0.000	0.307
9	1.217	38	0.027	I	0.004	0.000	0.011
10	3.926	49	0.297	C	0.037	0.000	0.072
11	1.617	50	0.339	A	0.013	0.000	0.160
12	2.828	55	0.082	B	0.035	0.000	0.027
13	3.381	58	0.001	L	0.039	0.000	0.000
14	3.921	60	0.570	E	0.041	0.000	0.121
15	3.594	66	0.131		0.039	0.043	0.022
16	1.979	66	0.170		0.030	0.000	0.057
17	3.764	60	0.001		0.037	0.016	0.000
18	3.503	61	0.131		0.036	0.000	0.028
19	4.031	57	0.001		0.038	0.000	0.000
20	4.067	59	0.005		0.039	0.093	0.001
21	3.712	66	0.037		0.039	0.366	0.014
22	4.005	61	0.001		0.040	0.015	0.000
23	4.049	65	0.002		0.042	0.173	0.000
24	3.180	68	0.000		0.039	0.315	0.000
25	3.844	70	0.001		0.042	0.063	0.000
26	3.856	71	0.000		0.044	0.153	0.000
27	3.317	70	0.001		0.037	0.233	0.000
28	0.897	51	0.022		0.001	0.000	0.049
29	0.630	45	0.132		0.000	0.000	0.161
30	3.082	50	0.108		0.033	0.000	0.032
31	2.361	49	0.007		0.023	0.000	0.002
SUM	92.439	-	5.598	N.A.	0.917	1.582	-
AVG	2.982	56	0.181	N.A.	0.030	0.051	0.050
NBS ID	Q001	N113			Q102		N111

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
COLLECTOR ARRAY PERFORMANCE

SITE: BILLINGS SHIPPING BILLINGS, MONT.SOLAR/2066-79/05
REPORT PERIOD: MAY,1979

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	OPERATIONAL INCIDENT ENERGY MILLION BTU	COLLECTED SOLAR ENERGY MILLION BTU	DAYTIME AMBIENT TEMP DEG F	COLLECTOR ARRAY EFFICIENCY
1	0.695	0.044	0.003	48	0.004
2	2.126	1.157	0.489	49	0.230
3	3.845	3.412	1.369	63	0.356
4	2.297	1.873	0.669	61	0.291
5	3.216	2.738	0.333	67	0.104
6	*	*	*	*	*
7	4.863	4.355	1.598	53	0.328
8	1.663	0.320	0.144	44	0.086
9	1.217	0.247	0.179	39	0.147
10	3.926	3.487	1.410	56	0.359
11	1.617	0.862	0.280	55	0.173
12	2.828	2.456	0.715	65	0.253
13	3.381	3.116	0.840	66	0.248
14	3.921	3.604	1.128	70	0.288
15	3.584	3.283	0.976	80	0.272
16	1.979	1.670	0.154	79	0.078
17	3.764	3.404	0.773	69	0.205
18	3.503	3.200	0.566	71	0.162
19	4.031	3.728	0.786	64	0.195
20	4.067	3.739	0.792	66	0.195
21	3.712	3.399	0.590	80	0.159
22	4.005	3.741	0.833	71	0.208
23	4.049	3.765	0.843	76	0.208
24	3.180	2.907	0.737	85	0.232
25	3.844	3.633	0.880	79	0.229
26	3.856	3.602	0.934	84	0.242
27	3.317	3.024	0.868	90	0.262
28	0.897	0.096	0.051	51	0.057
29	0.630	0.000	0.000	47	0.000
30	3.082	2.551	0.730	60	0.237
31	2.361	1.889	0.317	52	0.134
SUM	92.439	77.809	20.650	-	-
AVG	2.982	2.510	0.666	65	0.223
NBSID	Q001		Q100		N100

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
STORAGE PERFORMANCE

SITE: BILLINGS SHIPPING BILLINGS, MONT. SOLAR/2066-79/05
REPORT PERIOD: MAY,1979

DAY OF MONTH	ENERGY TO STORAGE MILLION BTU	ENERGY FROM STORAGE MILLION BTU	CHANGE IN STORED ENERGY MILLION BTU	STORAGE AVERAGE TEMP DEG F	STORAGE EFFICIENCY
1	0.000	0.221	-0.386	110	1.000
2	0.235	0.440	-0.280	95	0.681
3	0.877	0.233	0.490	101	0.826
4	0.325	0.202	0.053	111	0.781
5	0.000	0.000	-0.045	114	1.000
6	*	*	*	*	*
7	0.554	0.281	0.144	114	0.767
8	-0.040	0.647	-0.725	98	1.933
9	0.045	0.014	0.021	81	0.769
10	0.870	0.002	0.796	102	0.917
11	0.158	0.298	-0.247	112	0.324
12	0.600	0.049	0.409	120	0.763
13	0.568	0.000	0.390	139	0.687
14	0.817	0.453	0.108	145	0.686
15	0.727	0.112	0.281	159	0.540
16	0.000	0.170	-0.206	163	1.000
17	0.450	0.000	0.166	162	0.368
18	0.324	0.129	0.018	166	0.455
19	0.383	0.000	0.162	172	0.424
20	0.311	0.000	0.121	180	0.388
21	0.000	0.037	-0.339	171	1.000
22	0.545	0.000	0.248	171	0.454
23	0.467	0.000	0.017	178	0.036
24	0.221	0.000	-0.202	173	-0.915
25	0.541	0.000	0.110	171	0.203
26	0.541	0.000	0.046	176	0.086
27	0.417	0.000	-0.023	176	-0.056
28	0.000	0.022	-0.782	151	1.000
29	0.000	0.132	-0.283	127	1.000
30	0.573	0.108	0.287	128	0.688
31	0.104	0.000	0.022	136	0.212
SUM	10.967	3.669	0.382	-	-
AVG	0.354	0.118	0.012	140	0.369
NBS ID	Q200	Q201	Q202		N108

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SPACE HEATING SUBSYSTEM

SITE: BILLINGS SHIPPING — BILLINGS, MONT. — SOLAR/2066-79/05
REPORT PERIOD: MAY, 1979

DAY OF MON.	SPACE HEATING LOAD MILLION BTU	SOLAR FR.OF LOAD PCT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	BLDG TEMP DEG. F	AMB TEMP DEG. F
1	0.486	37	0.182	0.077	0.304		0.804	-0.030	0.304	70	43
2	1.979	23	0.453	0.195	1.525	N	2.559	-0.030	0.756	71	43
3	2.207	19	0.414	0.262	1.792	C	2.911	-0.022	0.691	74	48
4	0.983	38	0.370	0.090	0.613	T	1.120	-0.007	0.617	73	53
5	0.000	0	0.000	0.000	0.000		0.021	0.000	0.000	71	59
6	*	*	*	*	*	A	*	*	*	*	*
7	1.960	43	0.851	0.163	1.109	P	1.637	-0.012	1.419	72	48
8	2.481	21	0.511	0.241	1.970	P	3.077	-0.027	0.852	71	39
9	2.360	1	0.013	0.200	2.347	L	3.678	-0.002	0.022	73	38
10	1.094	26	0.281	0.102	0.813	I	1.795	-0.003	0.469	72	49
11	0.408	64	0.259	0.042	0.148	C	0.711	-0.004	0.432	72	50
12	0.211	37	0.077	0.008	0.134	A	0.601	-0.001	0.129	70	55
13	0.000	0	0.000	0.000	0.000	B	0.471	0.000	0.000	70	58
14	0.622	76	0.473	0.049	0.150	L	0.638	-0.004	0.788	74	60
15	0.108	74	0.079	0.017	0.028	E	0.471	-0.001	0.132	74	66
16	0.113	100	0.113	0.032	0.000		0.416	-0.000	0.188	75	66
17	0.000	0	0.000	0.009	0.000		0.453	-0.000	0.000	74	60
18	0.145	69	0.100	0.017	0.046		0.453	-0.000	0.166	74	61
19	0.000	0	0.000	0.000	0.000		0.434	0.000	0.000	74	57
20	0.003	100	0.003	0.000	0.000		0.434	-0.000	0.005	73	59
21	0.052	100	0.052	0.083	0.000		0.444	-0.000	0.087	76	66
22	0.000	100	0.000	0.013	0.000		0.434	-0.000	0.000	75	61
23	0.000	0	0.000	0.043	0.000		0.425	-0.000	0.000	76	65
24	0.000	0	0.000	0.016	0.000		0.462	-0.000	0.000	78	68
25	0.000	0	0.000	0.043	0.000		0.425	0.000	0.000	77	70
26	0.000	0	0.000	0.000	0.000		0.388	0.000	0.000	78	71
27	0.000	0	0.000	0.000	0.000		0.397	0.000	0.000	79	70
28	0.044	100	0.044	0.070	0.000		0.425	-0.000	0.074	74	51
29	0.168	61	0.102	0.018	0.066		0.517	-0.001	0.169	72	45
30	0.170	57	0.097	0.010	0.072		0.908	-0.001	0.162	73	50
31	0.142	4	0.006	0.094	0.136		0.462	-0.001	0.010	72	49
SUM	16.259	-	4.631	1.958	11.628	N.A.	28.903	-0.153	7.719	-	-
AVG	0.524	28	0.149	0.063	0.375	N.A.	0.932	-0.005	0.249	74	56
NBS	Q402	N400	Q400	Q403	Q401		Q410	Q415	Q417	N406	N113

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENVIRONMENTAL SUMMARY

SITE: BILLINGS SHIPPING BILLINGS, MONT. SOLAR/2066-79/05
REPORT PERIOD: MAY,1979

DAY OF MONTH	TOTAL INSOLATION BTU/SQ.FT	DIFFUSE INSOLATION BTU/SQ.FT	AMBIENT TEMPERATURE DEG F	DAYTIME AMBIENT TEMP DEG F	RELATIVE HUMIDITY PERCENT	WIND DIRECTION DEGREES	WIND SPEED M.P.H.
1	376	N	43	48	N	N	N
2	1150	O	43	49	O	O	O
3	2080	T	48	63	T	T	T
4	1243		53	61			
5	1741	A	59	67	A	A	A
6	*	P	*	*	P	P	P
7	2632	P	48	53	P	P	P
8	900	L	39	44	L	L	L
9	659	I	38	39	I	I	I
10	2124	C	49	56	C	C	C
11	875	A	50	55	A	A	A
12	1530	B	55	65	B	B	B
13	1829	L	58	66	L	L	L
14	2121	E	60	70	E	E	E
15	1939		66	80			
16	1071		66	79			
17	2037		60	69			
18	1895		61	71			
19	2181		57	64			
20	2201		59	66			
21	2009		66	80			
22	2167		61	71			
23	2191		65	76			
24	1721		68	85			
25	2080		70	79			
26	2087		71	84			
27	1795		70	90			
28	485		51	51			
29	341		45	47			
30	1668		50	60			
31	1278		49	52			
SUM	50021	N.A.	-	-	-	-	-
AVG	1614	N.A.	56	65	N.A.	N.A.	N.A.
NBS ID	Q001		N113			N115	N114

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